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12 March 1981

... FBIS 40TH YEAR 1941-81 ...

West Europe Report

SCIENCE AND TECHNOLOGY

(FOUO 2/81)

FBIS FOREIGN BROADCAST INFORMATION SERVICE

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FOREIGN BROADCAST INFORMATION SERVICE
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26 February 1981

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On behalf of all of us in FBIS I wish to express appreciation to our readers who have guided our efforts throughout the years.

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WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

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CONTENTS

ENERGY

CONSORTIUM RECEIVES GOVERNMENT FUNDS FOR WIND POWER PLANT

Paris REVUE DE L'ENERGIE in French Nov 80 p 420

[Text] Four British enterprises will participate conjointly in perfecting a new wind power plant. They are Aircraft Designs, McAlpine, Nei Clarke Chapman Cranes Ltd and Engineering and Power Consultants Ltd.

The consortium has received a grant of Fr400,000 from the government to carry out over a 15-month period a study which will lead to the construction of a 25 meter diameter windmill, with an output of 130 kw. This windmill, which can be operational in less than 2 years, will be used as a test-bed for larger machines which one hopes to build later on.

The prototype will be based on a verticle axle, variable-geometry turbine invented in 1975 by Dr Peter Musgrove of the University of Reading, near London. Dr Musgrove, who has already built machines of 3 and 6 meter diameters, will act as consultant for the new project.

The Musgrove machine has verticle blades mounted at either end of a sail arm turning horizontally on a verticle axle attached to the top of a concrete tower. The prototype's blades will probably be made out of carbon fibre, and microcomputers will automatically regulate their angle according to the variable force of the wind, so as to preserve a uniform supply of current.

Dr Musgrove claims he has identified eight pegions along British coasts where electrcity can be produced from wind; he anticipates the installation of series of machines in shallow water several kilometers from shore where they would pick up more wind than on land. According to his anticipations, these machines would have a diameter of 100 meters, producign 10 megawatts of electricity and each series would comprise around 100 machines.

The 130kw prototype would nonetheless present an important commercial interest, owing to its dimension and output which might arouse the interest of farmers and the decision makers of agglomerations in many countries.

9330
CSO: 3102

INDUSTRIAL TECHNOLOGY

TESTS OF NEW CARBON FIBER WING TO BEGIN THIS YEAR

Paris AIR & COSMOS in French 3 Jan 81 pp 16-17

[Article by Jacques Morisset: "Aerospatiale and Dassault-Breguet: Carbon Wing Tests Beginning This Year"]

[Text] Aerospatiale and Dassault-Breguet have started making the first carbon fiber components of a wing spar for which tests will begin this year.

As our cover photo which was taken recently at Suresnes by Michel Isaac shows, we are talking about an important process, as this wing spar has characteristics not found up to now simultaneously: a primary structure made entirely out of carbon fiber-based composite material, large dimensions (each spar will be 5.43 meters long and 1.5 meters wide), and panel sections self-braced by "built-in" stringers.

A Joint Program

As our readers already know (cf. AIR ET COSMOS, issues 790, 825 and 838), the research, construction and testing of this wing spar come under a development program supported by the French Official Services under an arrangement with the Technical Service of Aeronautical Programs (STPA).

Government support is given in the form of an arrangement including both of the manufacturers (who are participating on an equal basis in financing the operation) according to which they work on a joint and mutually supportive basis; the project is designated "V 10 F."

As is known, in 1976, Aerospatiale and Dassault-Breguet had already signed a draft agreement to share their knowledge. But the V 10 F operation goes much further than a simple information exchange. Research on the new wing spar was done within a joint working group made up of teams from the research departments in Saint-Cloud (AMD/BA) and Toulouse (SNIAS), and coordinators were appointed to organize cooperative efforts both in the earlier stages (research, laboratory work) as well as later on (manufacturing, inspection and tests). The role of these coordinators is just as important in the area of external relations. The interview granted to us by the two coordinators, Messrs Brusson (for SNIAS) and Cordie (for Dassault-Breguet) showed that one goal has already been accomplished, namely working as a team and sharing the experience each firm has had.

Constructing and flight-testing a large primary structure represent a significant step in the development of uses for composite materials, especially since in the case of the V 10 F we are not talking about using them on a partial basis but rather about total use: the wing spar is made up in its entirety (longerons, ribs, and upper and lower wing surface panels) of composite carbon.

Choice of Materials

The carbon fiber used is T.300 made from a textile fiber by the Japanese firm Toray. Two resins are commonly used: CIBA 914 and NARMCO 5208; the former had been tried out first and proposed by Dassault-Breguet and the latter by Aerospa iale, the main criteria of choice being how easy it was to work with and what holding power it had over time (aging). We are talking in both cases about resins polymerized at 180° Centigrade and which can be used at relatively high temperatures (up to 135° Centigrade) without any difficulty. Another advantage these two resins have is that they are known quantities and are tried and true.

We note for the record that in the case of the V 10 F wing, it was Dassault-Breguet who ended up using the NARMCO resin for their first components and Aerospatiale the CIBA resin: a good example of how their testing interfaced. In fact the two manufacturers made their decisions at the same time to use the two resins since they both have satisfactory characteristics.

The Timetable

The partial tests which have been accomplished involved:

--Resistance (mechanical characteristics, stress), and

--Feasibility, that is, workshop adaptation.

As of now these tests are 90 percent completed. The components have been completely defined and designed, and the manufacture of the first parts for wing spar ground trials has started. We are actually talking about "fly-able" parts. The first ones are of course allocated for the two halfwings for static and stress tests. They will be sent to the Toulouse Center for Aeronautical Testing (CEAT). The center will receive the wing spars during the coming holiday period to start tests at the end of the year. At that same time the assembly of spars for flight use will be underway.

The entire wing is to be completed in spring 1982 for "manufacturer" test flights starting during that year's holidays. At the end of 1982 certification should be obtained for public transportation of paying passengers. The new wing will be tried out on the Falcon 10 number 03 and then taken off and put back on a standard Falcon 10, probably one of those used by Europe Falcon Service, which will make it easier to have extensive follow-up on that wing for several years.

Manufacturing Divided Up

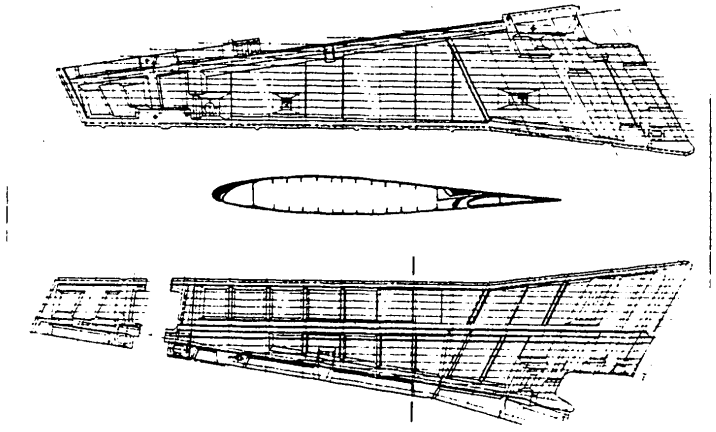
So four spars will be built: two for the halfwings for ground tests and two for the wing to be flown. Of these four spars, two will be made by Dassault-Breguet

(the lefthand ones) and two by Aerospatiale (the righthand ones), since the work is shared out half and half between the manufacturers. The actual parts are being made in specialized workshops of Dassault-Breguet in Biarritz and of Aerospatiale in Nantes which now have long and valuable experience in the area of development and industrial use of components made of composite materials. The assembly operations will take place in Saint-Cloud, Nantes and Suresnes (where the test laboratories are also located) respectively.

Weight Savings

We can definitely say that the savings in weight which has been calculated (and verified on the first components made) is around 20 percent, but we must add that the structure of this wing was patterned after that of current metallic wings and has therefore not be optimized for carbon. A reconceived original structure would certainly be lighter.

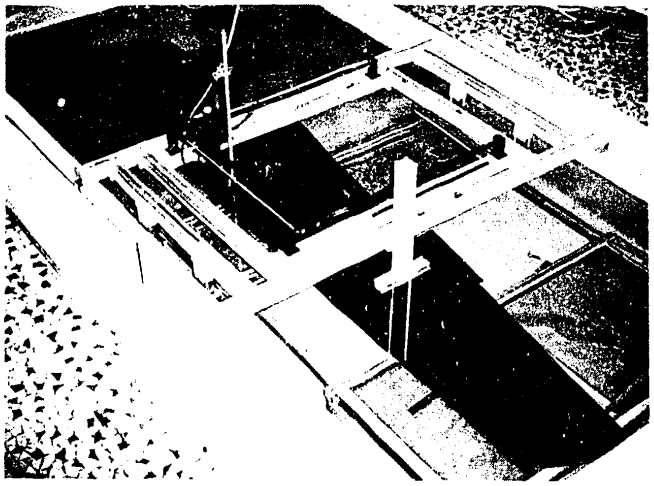
Finally we make the observation that for this V 10 F program the French Offical Services have undertaken to work out certification standards to apply to basic structural parts made out of composite materials. This is not the least interesting aspect of the whole operation because it represents preparation for the future.



[p 16 illustration caption] V 10 F PROTOTYPE...UPPER WING SURFACE...LOWER WING SURFACE...In this drawing the upper wing surface panel of the V 10 F wing spar is represented on top and the three panels which make up the undersurface below.

[Photos on following page]

The Dassault factory in Biarritz: panels for the wing underside (the forward ones) of the V 10 F wing spar. Each panel weighs about 20 kilos.



In this "swimming pool" in the Suresnes facility a panel for the upper wing surface is subjected to nondestructive ultrasonic testing. The panel weighs 50 kilos.

9631
CSO: 3102

INDUSTRIAL TECHNOLOGY

BRIEFS

FRENCH INDUSTRIAL AUTOMATION--Industrial robots are really starting up in France: the ADEPA (Agency for the Development of Automated Production) is starting three operations as of the beginning of 1981: 1) an "Automatic Functioning Machines" Day in April aimed at providing information for industrial concerns; 2) training courses in production equipment automation (beginning in May); and 3) Science and Technology of Automated Production Days in Toulouse, 3-5 June. [Text] [Paris LA LETTRE DE L'EXPANSION in French 29 Dec 80 p 3] 9631

CSO: 3102

SCIENCE POLICY

BUDGET, POLICY FOR RESEARCH, DEVELOPMENT IN 1981 OUTLINED

Paris LE PROGRES SCIENTIFIQUE in French Sep-Oct 80 pp 13-51

[Article: "The Proposed Budget for 1981"]

[Excerpts] The General Framework: A Research Strategy in a 10-Year Perspective

At the request of the president of the republic, the secretary of state for research was assigned to work out a research strategy in a 10-year perspective that defines, for the coming years, the orientations of national scientific policy.

The broad outlines of this 10-year strategy were decreed at the central planning council meeting of 26 July 1979. They deal with the orientation of research, its organization and its means.

The orientation of research will be guided by two closely correlated objectives: to participate actively in the dynamic of the sciences and technologies on the international level; to repond to the challenges that French society and the French economy will have to face. To this end, it will be necessary to promote high-quality research in all the major areas of knowledge. Four priority orientations have been identified in particular:

--putting to advantage the scientific and technological achievements that have come to maturity, especially in the area of the information and communication technologies and in the area of space techniques;

--intensifying the research effort in the areas destined to have an important impact on the economy and society, especially energy, on the one hand, and on the other, the applications of biology;

--encouraging interdisciplinary and intersectorial cooperation, especially in the area of materials and in the area of the use of the methods and tools of physics in various disciplines (chemistry, biology, medicine, etc);

--developing the research on the complex systems such as the atmosphere, the marine environment, biology-society interactions (scientific ecology, neurobiology) and the interactions between the technologies in the area of social facilities (city-planning, transport, housing) and the evolution of lifestyles.

The actions relating to the organization of research should have the objective of opening up and reaching out to the outside world: actions on scientific employment relating to the conditions of recruitment and mobility of researchers; actions aimed at greatly increasing cooperation at all levels among the laboratories, public and private, and among the organisms.

Finally, the means, both public and private, devoted to research should grow in the coming years in such a way that the proportion of gross national product devoted to R and D activities gradually reaches the level achieved in the industrialized countries that are most active in research.

On the bases thus laid, the preparation of the 10-year research plan has resulted, during the past year, in some important work of reflection, carried on under the aegis of the secretariat of state for research, and some of it has already been translated into governmental decisions. Furthermore, the work of preparation of the Eighth Plan in the area of research has been conducted in relation to the work relative to the 10-year research plan.

The principal elements of this 10-year strategy concern:

--the financing of public research;

--scientific employment;

--big scientific equipment;

--the opening-up of the research apparatus;

--the evolution and balances of the financing of research.

A Strategy of Balanced Growth

France is currently devoting to research and development about 1.8 percent of the gross national product--a figure that has remained quite constant since 1973. The rate is close to 2.3 percent in the FRG, reaches 2.4 percent in the United States, and appears to be 1.9 percent in Japan, which is setting itself the target of raising it to 2.5 percent in 1985. The central planning council, at its 26 July 1980 meeting, has set the following objective for France: the public credits for research will grow in the coming years at such a rate that the proportion of GNP devoted to research gradually approaches that achieved in the industrialized countries of comparable size and most active in research This target therefore implies giving a considerable push to increasing the means devoted to research and development.

The Enterprises

With regard to the enterprises, the share of research that they finance is rather lower than what one observes in other countries. It represents 0.8 percent of GNP as against 1.1 to 1.2 percent in the principal industrial countries. It should be noted, though, that the research and development expenditures of the telecommunications sector are accounted for in France as being of the public sector, even though their financing, which is provided by the supplementary PTT [Posts, Telegraph and Telecommunications] budget, is not at the expense of the taxpayers. On the basis of this correction, the share of the enterprises, in the broad sense, approaches 47 percent of national research and development expenses.

It nonetheless remains desirable that the enterprises contribute in future a larger share of the expenses of research and development. This implies growth of at least five points more than the gross national product, whereas for the last 5 years, the enterprises' expenditures have progressed at a rate close to that of the GNP. Thus a real change of behavior by the enterprises is to be encouraged.

This effort can only be a gradual one. And strengthening of the present means of incentive--innovation bonus, the action of the ANVAR [National Agency for Valorization of Research], concerted activities and program contracts from the research fund and from certain ministerial funds--will help to achieve this result.

Public Financing

With regard to public financing, the orientation resulting from the decisions of the central planning council has been expressed in the draft finance law for 1981, in such a way as to respond to the most pressing needs for development of research and development potential:

--strengthening of the means devoted to exploratory and purpose-directed research, mainly through increasing the operational means for it, including both program support and scientific equipment, the relative proportion for which has effectively decreased in recent years because of the specific evolution of certain basic expenditures for research (energy, salaries);

--startup of purpose-directed programs, taking best advantage of the promising routes opened up by the new forms of cooperation among the organisms and domains of research;

--continuation of the technological development programs and development of aids to industrial research and to innovation.

Finally, the draft finance law for 1981 adopts the outlook of a balance between research and development that preserves the share of medium-term and long-term research that is indispensable to preparation for the future.

The Technological Development Programs

In the course of the past decade, the state has taken in charge a number of programs for development of technologies that have arrived at maturity, whenever its intervention as promoter or customer was called for because of the strategic character of the area concerned. This was the case with the beg civil aeronautics programs, with the space applications program of the National Center for Space Studies (CNES), with the electronuclear program of the Atomic Energy Commission (CEA), with data-processing and components, and more recently, with the activities of the Solar Energy Commision (COMES) in the area of new energies and the activities conducted in the ocean sector.

In this total picture, a special place should be reserved for the aid-to-innovation program run by ANVAR. This does not in fact involve a specific technical-economic objective as such, but rather general promotion of innovation throughout the entire fabric of industry: ANVAR's action has largely been taking the place of the action of the other organisms and agencies when industrialization of new products or methods can be envisioned.

Technological Development Programs

Organisms and Programs	1980 Personnel	1980 Operating Credits (millions of francs)	1980 Equipment Credits (AP)* (millions of francs)	1980 Total Cost (millions of francs)	1981 Personnel	1981 Operating Credits (millions of francs)	1981 Equipment Credits (AP)* (millions of francs)	1981 Total Cost (millions of francs)
Electronuclear Program	6,660	1,388.90	1,246.60	2,635.50	6,660	1,601.30	1,361.20	2,962.50
Space Applications	1,075	211.70	816.83	1,028.53	1,080	255.70	1,028.98[1]	1,284.68
Activities in the ocean sector								
Aquiculture farms and underwater mining programs	"	"	6.67	6.67	"	"	10	10
Activities in the solar-energy sector	"	"	43.37	43.37	"	"	65.40	65.40
National Agency for Valorization of Research	176	2[2]	416.70	418.70	186	39.788	450.532	490.32
Action in support of innovation	"	--	47.30	47.30	"	"	46.47	46.47
Agency for data-processing	[113][3]	[17.20][3]			121	25.06	114.44	139.50
Data-processing industries and applications and high-level data-processing personnel	30	6.48	418.642	425.122	50	13.468	355	368.468
Big civil aeronautics programs	"	--	1,222.60	1,222.60			1,337	1,337
Total	7,941	1,609.08	4,218.712	5,827.792	8.097	1,935.316	4,769.022	6,704.338

1. Not including Fr 14.7 million added-value tax to which the CNES is subject.
2. To which is added Fr 14.7 million written into the CNRS [National Center for Scientific Research] budget in 1980.
3. Operating and personnel credits for the data-processing agency, not specified individually in 1980 in the IRIA [expansion unknown] budget chapter, included in the interministerial research package, and entered here as a memorandum.

* [expansion unknown]

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The financing growth specified, in the draft budget for 1981, for the technological development programs is 14.99 percent in program authorizations and operating credits; the corresponding increase in real terms (4.1 percent) is a little lower than what is proposed under the heading of the interministerial research package (6.9 percent), producing a special effort in favor of the long term.

The evolution of the means allocated, in these proposals, to the various programs is described in the table on the preceding page.

A sizable part of the new means proposed for 1981 is due to the launching or development of activities in the space sector (launchers, telecommunications, observation of earth by satellite), the financing of which is taking 30 percent of the supplementary credits planned for 1981. A very big effort is also proposed in favor of the activities of the COMES (up 50.8 percent).

11267
CSO: 3102

TRANSPORTATION

SAUDI ARABIAN AIRLINES ORDERS A300 B4-600 AIRBUSES

Paris AIR & COSMOS in French 27 Dec 80 pp 19, 32

[Text] The order of 11 A300 B4-600s placed by Saudia Arabian Airlines with Airbus Industrie and announced 17 December (cf AIR & COSMOS no 839, p 23) presents a double aspect:

--this is the first order of an A300-600, described in our last issue: for Airbus Industrie, the decision is therefore important, it has, moreover, a good chance of giving rise to other orders among neighboring companies. The A300-600 is definitively inaugurated, marketed and sold. The traditional comparisons of Airbus with other planes, particularly the B-767, will therefore have to be made henceforth by taking into account the A310 and A300-600 and not the present A300 B2/B4;

--for the first time, Rolls Royce is in a good position to equip the European airplane. An agreement in principle has been announced, let us recall, at the last Bourget airshow, that is to say in June of 1979, but the carrying out of this agreement depended in the first instance on the interest a buyer might have in an Airbus equipped with RB 211 engines and not General Electric or Pratt and Whitney engines which, up to present, have exclusively equipped the A300. Now it seems indeed that Saudia could be the company to launch an A300-600 with RB 211-524 engines, because this engine already equips the 19 Saudia L-1011 "Tristars," and will equip (with RB 211-524 Cs in a first stage) its 10 B747s.

The engine offered Saudia is the RB 211-524 D4 with a 53,000 pound (24 ton) thrust, to which Rolls Royce attributes a specific consumption 5 percent less than that of the CF6-80A or the JT9D-7R...while at the same time recalling that the RB 211-524C already brings, from this point of view, a gain of 8 percent compared with the JT90-7Q and 7F. If Saudia chooses Rolls Royce, the A300-600 prototype will thus fly powered by RB 211-524 engines. The adaptation of the British engine to the A300 will require an investment of around 25 million pounds (through certification), Rolls Royce providing the necessary financial arrangements.

It must also be noted that the pylons will be new, for the RB 211 is shorter (because of its three shafts) than its rivals, and its mounting under the Airbus wing would not be optimal with the new "all-purpose" pylon developed by SNIAS.

At the moment we were writing these lines (23 December), the Saudia decision was considered imminent.

PHOTO CAPTION p 19

The first of nine A300 B4-100s intended for Iberia (plane no 130) left its loft last month and was immediately painted with the Spanish company's colors: it will be delivered to Iberia late February or early March 1981. Iberia, after SAS, will be the second company to place in service A300s with Pratt and Whitney JT 9D engines.

9330
CSO: 3102

TRANSPORTATION

NEW FOUR-CYLINDER BMW ENGINES REDUCE FUEL CONSUMPTION

Stuttgart MTZ MOTORTECHNISCHE ZEITSCHRIFT in German Dec 80 pp 547-548

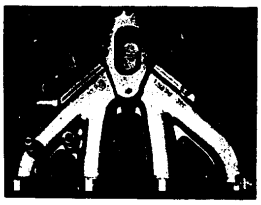
[Text] The continuing development of the BMW engines in the 3-, 5-, and 7-series demonstrates that low fuel consumption can be realized in spite of high output in the engines of cars in the higher and upper-middle classes. The introduction of motronic in the 7-series in the BMW 732i and the 633CSi will be continued beginning in 1981 with Motronic-2 in the BMW 735i and the 635CSi. The microcomputer which controls fuel injection and ignition is being given anaadditional Lambda identification field in its storage, from which the most economical fuel-to-air ratio for every operating point of the engine is determined. It is expected to yield another 5-percent improvement in fuel consumption figures.

Also for the engines of the 3-series the goal of this continuing development was an improvement in the consumption for what is already an economical engine. At the same time performance was to be improved.

In the BMW 316 with the 66kW (90 hp) engine, it is principally acceleration and flexibility figures that have been improved: from 0-100 km/hour in 12.5 secs (by 10 percent) and from 80-120 km/hour in 13.3 secs (by 18 percent). Top speed rose by 2 percent to 163 km/hour, while overall consumption dropped by more than 5 percent.

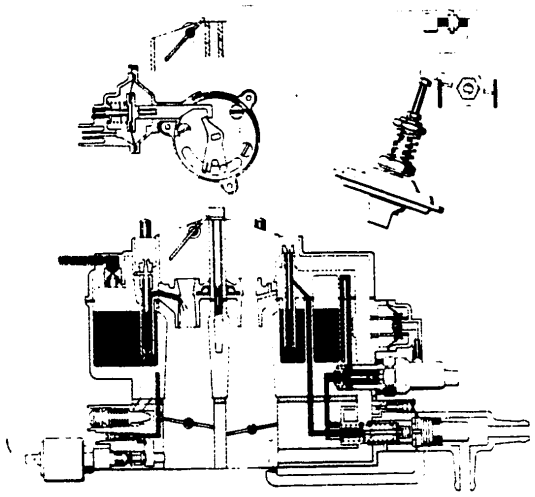
These improvements were achieved by increasing the capacity of the engine in the BMW 316 by more than 12 percent and raising the compression ratio by 14.5 percent to 9.5:1. In addition, the inlet manifold in Fig. 1, for use with the new Solex compound carburetor for operation at the leanest possible mixture, was redesigned to achieve a generous torque curve.

Fig. 1. Inlet manifold of the BMW 316 engine for the new 2B4 carburetor



The warmup phase, which is critical for fuel consumption, can be metered exactly with this refined mixture control--Fig. 2.

Fig. 2. The new 2B4 downdraft staged carburetor from Pierburg with special warmup and hot-start device (TN choke)

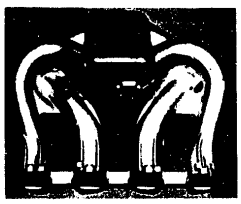


The needle-operated TN choke (T for thermo, N for bypass) is new in the carburetor technology developed at Pierburg and used here for the first time at BMW. Independently of coolant temperature, a flexible element controls the depth of insertion of a conical needle valve. Hot-start behavior was also decisively improved by the use of the throttle valve adjustment lever.

The fuel-injected engine of the BMW 318i with 77 kW (105 hp) raises top speed by 5 percent to 173 km/hour and improves acceleration from 0-100 km/hour by 3.4 percent (11.5 secs). Consumption dropped on the average by 7 percent and in city traffic by as much as nearly 13 percent.

The compression ratio in the injection engine could be raised by 14 percent to 10:1; this presupposes optimal mixture, combustion chamber shape and ignition. The new inlet manifold for the K-Jetronic, derived in principal from the 323i, is testimony to a high state of casting technology--Fig. 3.

Fig. 3. Inlet manifold of the BMW 318i engine for Bosch K-Jetronic



The air volume sensor sits directly under the rectangular collector from which the individual curved pipes lead off. Thus, the entire injection unit is built onto the engine and is no longer mounted to the body as in earlier versions--Fig. 4.

Fig. 4. Cross section through the engine and the directly mounted K-Jetronic injection unit of the BMW 318i

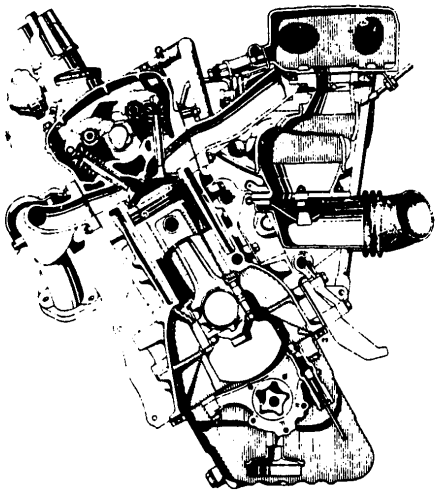


Bild 4. Querschnitt durch den Motor und die direkt angebaute K-Jetronic-Einspritzanlage des BMW 318i

The combustion chamber design with the spherical turbulence chamber was taken over from the successful six-cylinder engines. Both 316 and 318i engines now have the same capacity of 1,766 cm^3 and the same bore-to-stroke ratio of 89/71. Hybrid transistor ignition is based on modern electronics technology.

The horsepower and torque curves in Fig. 5 show such favorable characteristics that the final drive ratio could be reduced by 5 percent, which in turn affects fuel consumption favorably. The following figures were obtained according to DIN [German Industrial Standard] 70030:

Fuel consumption in liters/100 km:

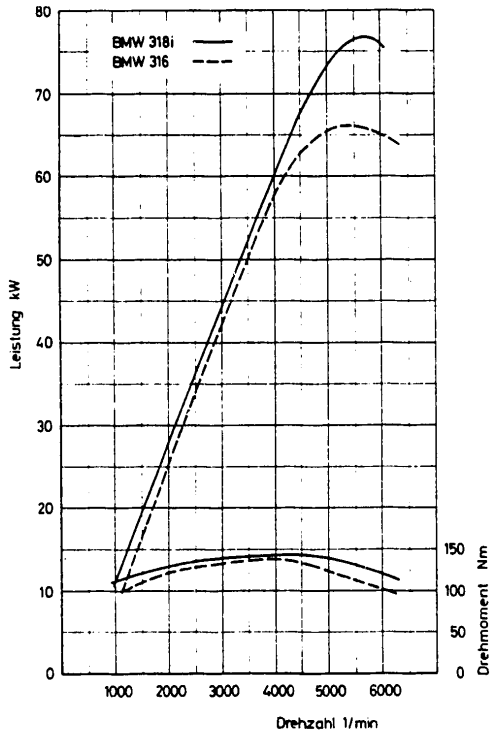
	BMW 316 (66 kW)	BMW 318i (77 kW)
90 km/hour	6.8	7.1
120 km/hour	9.3	9.1
City	11.0	10.1

The base model in the 5-series, the BMW 518, like the 316/318i, is now powered by the 1,766 cm^3 four-cylinder engine with a higher compression ratio of 9.5:1, the

new compound 2B4 carburetor, new combustion chamber shape and transistor ignition. Two fundamental advantages accrued. First the car became livelier; second, consumption was reduced by an average of 5 percent.

Fig. 5. Power and torque curves for the new 1,766 cm^3 four-cylinder BMW engines

Power in kW



Torque in Nm

Engine speed in revs/min

		BMW 316	BMW 318i
Max. power	kW/hp	66/90	77/105
at revs/min		5,500	5,800
Max. torque	Nm	140	145
at revs/min		4,000	4,500

9581
CSO: 3102

TRANSPORTATION

VOLVO TESTS METHANOL-FUELED DIESEL ENGINES

Stuttgart MTZ MOTORTECHNISCHE ZEITSCHRIFT in German Dec 80 p 558

[Text] In conjunction with the UITP congress in Helsinki, Volvo had shown a diesel engine for operation on methanol. Two engines of this type were installed in two aritculated buses in Stockholm in 1979 and were to be tested for 2 years. The project is being carried out under the direction of the Swedish company Svensk Metanolutveckling AB and is being subsidized by the government. Volvo has been carrying out various tests with methanol operation since 1975. The test with two buses in Stockholm is the most comprehensive of this kind so far.

"It is an interesting project with respect to environmental protection and our preparedness for a crisis," said Tage Johansson, technical director of the Stockholm Transport Company at a press conference. "This test is an important step toward developing our potential for the future exploitation of other types of fuel in public transportation."

"We were forced to make only relatively small structural modifications to adapt the original diesel engine for methanol operation. The modifications for this two-fuel operation are limited to apertures for additional nozzle holders and an injection pump with its drive, Fig. 1. We also took into consideration the effects of methanol on certain synthetic materials in the engine," said Volvo's head of testing, Ernst Holmer.

Fig. 1. Cylinder head of the methanol engine with two injector nozzles

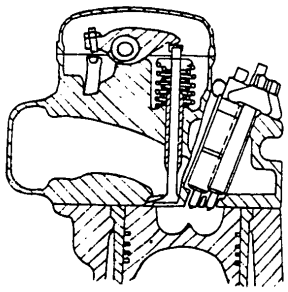


Bild 1. Zylinderkopf des Methanolmotors mit 2 Einspritzdüsen

Volvo's tests with methanol as a fuel in diesel engines have been continuing since the fall of 1975 under a contract from and in collaboration with Svensk Metanolutveckling. A prototype engine has been running for some time on methanol in a Volvo N 10 truck under normal operating conditions. Results have shown that about 70 to 85 percent of the diesel oil can be replaced by methanol, depending on the vehicle's transportation assignment.

Diesel oil is used to start the engine or when it is running at low revs/min. When the driver accelerates and wants more power from the engine, methanol assumes the major role as the fuel. Methanol has a lower cetane number and normally cannot be ignited by compression. In this context diesel oil is used as an aid to combustion.

"After extensive testing, this solution proved to be very effective," said Ernst Holmer and added: "Since two different fuels are used, two separate fuel systems are needed. The original diesel engine system is used for the methanol, while a new, separate system with a tank, primary pump, injection pump and nozzle holders was required for the diesel oil."

The normal consumption of diesel fuel in a city bus is 6.35 liters/10 km. In mixed operation, consumption is 10 liters/10 km of methanol and 1.8 liters/10 km of diesel oil--together, 11.8 liters/10 km--which requires almost double the fuel tank capacity. In Stockholm city traffic, the proportion of diesel fuel averages 17.5 percent of the total, or only 28.3 percent of the amount used in pure diesel operation.

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TRANSPORTATION

SYSTEM TO REGULATE MAGNETS FOR MAGNETIC LEVITATION VEHICLES

Duesseldorf VDI-Z in German 21/1980 p 934

[Article by Walter Breinl: "Proposal for an Immune Control System for a Magnetic Levitation Vehicle"]

[Text] Magnetic levitation technology is playing an important part in concepts for new transportation systems. Using the principle of magnetic levitation, the vehicle is lifted and guided by the attractive force of regulated magnets, with noncontact propulsion provided by a linear induction motor. Because of the flux requirements of the magnet, only a small air gap can be left between the anchor rail and the magnet. For safety at the hoped-for speeds, this requires precise and accurate regulation of the magnets; an unregulated magnet exhibits unstable behavior.

Since the parameters of the system are not precisely known, the aim of the present study is to design a control system for the individual levitating magnet which is, above all, immune to parameter deviations in the system. For example, the mass changes according to whether the vehicle is fully laden or empty. Similarly, the inductivity of the magnet can only be inadequately determined from experiments.

The regulator concept starts with linear state feedback. It is assumed that a portion of the state coordinates is available from measurements, and that the missing coordinates can be derived by means of an observer. Design of the regulator and the observer can be carried out separately because of the observer's separation capability. Optimal design follows a quadratic cost functional, taking the manipulated variable into account. In each case the results are simulated on a digital computer.

For the system with ideal state feedback (assuming that all state coordinates are available) system analysis for parameter sensitivity can be achieved by including the sensitivity functions in the cost functional. This determines feedback of the sensitivity functions as well as the state coordinates. Feedback coefficients are determined by iterative solution of the algebraic Riccati equation.

For the system with observer, sensitivity analysis is carried out through an expanded sensitivity model: In the event of parameter deviations a "detuning" takes place between the guideway and the observer, which appreciably increases sensitivity. In addition, the separation capability of the observer is lost. To prevent this, an immune observer design structure is proposed. The necessary conditions and assumptions are given. The basic requirement is that certain coordinates must be available